Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C., 20554

In the matter of	)	
	)	
Amendment of the Commission's	)	General Docket No. 90-314
Rules to Establish New Personal	)	ET Docket No. 92-100
Communications Services	)	
	)	

Comments of
XIRCOM CORPORATION

INTRODUCTION

1.1 Xircom manufactures Local Area Network products for portable computers

Xircom Corporation manufactures products which connect portable computers to Local Area Networks (LANs). Typical customers are business people who use portable computers while traveling and require a LAN connection to their portable when they return to the office.

1.2 Portable networking is a strong and growing market

Demand for Xircom's products has exploded since the company was founded in 1988. Unit sales volume is in excess of 20,000 adapters per month, and continues to grow rapidly.

Nearly 40% of our revenue comes from exports to Europe and Japan, and we are generally considered to be world leaders in portable LAN technology.

1.3 Portable networks require wireless LAN connections

With today's compact notebook and palmtop computers, the need for effective wireless LAN connections has become pressing.

Many of our customers want to carry their computers as they move around the office, to take notes in meetings, refer to electronically stored documents, check electronic mail, and so on. For such truly portable applications, wireless LANs are the only solution.

1.4 The 92-333 Notice of Proposed Rulemaking opens up attractive wireless LAN opportunities

The Commission's Notice of Proposed Rulemaking under docket 92-333 is of particular interest to Xircom, since it opens up opportunities for a variety of innovative wireless LAN products which are not possible under existing FCC rules.

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GENERAL COMMENTS

2.1 Radio communications should be used primarily for portable and mobile applications

Xircom believes in the principle that radio spectrum is a valuable resource which should be used primarily for applications where portability and mobility are essential. Communications between fixed points can best be served by media such as copper cable and optical fiber.

We suggest that unlicensed PCS rules should recognize the particular requirements and problems of mobile and portable devices.

2.2 The total bandwidth proposed for unlicensed applications appears to be insufficient, and we urge the Commission to set aside more spectrum

The Notice of Proposed Rulemaking identifies a 20 MHz band for all unlicensed services. Xircom believes that this is inadequate.

For example, between 5 and 10 MHz bandwidth is required for a wireless LANs to have performance comparable with a standard wired LAN. Since several wireless LANs will often be within radio range of each other, a total bandwidth of the order of 50 MHz is necessary.

Other applications such as wireless PBX systems will require similar amounts of spectrum. We strongly urge the Commission to consider allocation of additional frequency space to unlicensed services - one possibility would be the 1895 to 1910 MHz range, which does not appear to be set aside for any other purpose in the present NPRM.

SPECIFIC RESPONSES TO COMMISSION PROPOSALS

3.1 Common rules should govern all unlicensed communications in the Emerging Technologies bands

Xircom agrees that there are many unlicensed communications requirements, including wireless LANs, cordless telephones and wireless PBXs. We understand that the Commission wishes to specify common rules across all applications, an objective which we strongly support.

3.2 Splitting the available unlicensed band into three sub-bands will lead to inefficient operation, and runs against the spirit of an Emerging Technologies Rulemaking

The Commission has proposed wide, medium and narrow channel sub-bands, apparently to suit three particular classes of device: wireless LANs, DECT-type TDMA voice systems, and CT2-type voice systems.

Xircom believes that the available spectrum should be divided into as few sub-bands as possible, to minimize situations where one unlicensed sub-band is congested, while the others have vacant spectrum.

We would also point out that partitioning the band for products that *already exist* appears to run against the spirit of an Emerging Technologies rulemaking.

3.3 Digital communication applications can be categorized as asynchronous or isochronous

Most digital communications systems can be categorized as being either (i) asynchronous, demanding intermittent, high speed communications with minimum delay, or (ii) isochronous, requiring continuous, lower speed communications, with tolerance of moderate, bounded transmission delays.

By way of example, local area networks typically use asynchronous transmission, while digital voice systems are generally isochronous.

3.4 Rules for access to spectrum should be different for asynchronous and isochronous services

Of particular importance for unlicensed PCS are the different spectral access priorities shown by each category: asynchronous communications is fast-on, wide-band, with short-hold-time, while isochronous systems are medium-on, medium band, with long hold time.

In practice, these differences make it difficult for asynchronous and isochronous systems to share the same frequency spectrum without significant performance compromises.

3.5 Separate sub-bands for isochronous and asynchronous transmission are desirable

In view of the basic differences between isochronous and asynchronous communications, we recommend allocation of two unlicensed sub-bands. The asynchronous sub-band, from 1910 to 1920 MHz, should be unchannelized, while the isochronous sub-band, from 1920 to 1930 MHz, should be divided into eight 1.25 MHz wide channels.

3.6 Application classes should not be restricted a particular sub-band

Technical parameters for each sub-band must take account of the different characteristics of asynchronous and isochronous transmission. However, no attempt should be made to limit particular classes of application to particular sub-bands.

For example, wireless LAN products meeting the 'isochronous' rules would be permitted, as would voice products meeting the 'asynchronous' rules.

3.7 Power should be 250 mW in the asynchronous sub-band and 100 mW in the isochronous sub-band

The Commission has suggested a transmitter power limit of 1 watt in the 1910 to 1920 MHz band.

We believe that this is excessive, for two main reasons. First, such a high power level will increase the range over which interference might be possible between geographically adjacent systems, and second, generation of 1 watt at 1.9 GHz is not feasible in compact, battery powered portable equipment.

We suggest a maximum peak power level of no more than 250 mW in the 1910 to 1920 MHz sub-band. For the 1920 to 1930 MHz band, 100 mW peak power is appropriate.

3.8 Spectral density should be controlled in the asynchronous sub-band

The NPRM proposes a spectral density limit of 1.5 mW in any 3 kHz bandwidth for the 1910 to 1920 MHz sub-band.

We agree that spectral density limitation is desirable, since coexisting systems might occupy different bandwidths. However, we believe that a 3 kHz measurement bandwidth is unnecessarily narrow and would lead to time consuming compliance measurements.

Instead, we recommend a measurement bandwidth of 30 kHz, with 3 mW maximum peak power in that band. (This corresponds to 4 times the power of a 250 mW signal evenly distributed across 10 MHz.) In the channelized isochronous sub-band, no spectral density limit is required.

3.9 Out of sub-band emissions should be regulated in terms of absolute power

The Commission suggests that out of band emissions should be regulated by measurements relative to the fundamental signal.

Since the objective is to control interference to other systems, we suggest an absolute power limit of 10 μW for all spurious emissions and for both sub-bands.

Otherwise, we agree with the Commission's suggested measurement bandwidths and techniques.

3.10 Different frequency stability rules should be applied to each sub-band

The figure of +/- 0.0001 percent over time, temperature and supply voltage suggested in the NPRM is unnecessarily stringent, and probably not possible to realize in low cost, low powered, portable equipment.

Xircom suggests instead a figure of +/- 0.005 percent (+/- 50 parts per million) for products operating in the 1910 to 1920 MHz band. A tighter tolerance of +/- 0.001 percent, is appropriate for the 1920 to 1930 MHz band. Any potential emissions outside the defined sub-bands caused by frequency drift would be prohibited by the overall out of band limits described above.

3.11 Spectral efficiency should not be regulated

Xircom understands and supports the Commission's desire to maximize spectral efficiency. However, regulation of spectral efficiency will complicate the rules and lead to time consuming discussions of correct interpretation between Commission staff and equipment manufacturers.

We believe that market forces provide sufficient encouragement for spectrally efficient designs, and recommend deletion of this section from the new rules.

3.12 Band sharing with existing microwave users does not appear to be possible

The Commission asks for comments on band sharing between unlicensed devices and existing Part 94 point-to-point microwave users.

Xircom does not believe that this is possible, since portable devices may be carried to locations where they will cause interference to a Part 94 receiver.

For this reason, we believe that clear frequency spectrum is required for the unlicensed band.

3.13 Spectrum monitoring before transmission will not stop interference with Part 94 users

The commission has requested comment on whether sharing with existing part 94 users might be possible if unlicensed devices monitor the spectrum to be occupied before transmitting.

We do not believe that this is practicable, since a portable unit with a low gain antenna may not be able to detect a remote Part 94 transmitter, even though it is close enough to the corresponding Part 94 receiver to cause interference.

3.14 Spectrum monitoring before transmission will allow more efficient spectrum sharing between Part 15 users

Present Part 15 rules make no specific provisions for spectrum sharing - communications devices can transmit at any time, even if this causes interference to other users. Xircom urges the Commission to include a simple listen-before-transmit (LBT) procedure in the new rules.

Attachment A shows one example of a suitable LBT algorithm, which would substantially reduce Part 15 interference and improve overall spectral efficiency.

3.15 Unlicensed operation should not require a controlling base station

The Commission asks whether a base station should be required to control the operation of portable and mobile unlicensed devices. Xircom does not support this idea, since ad-hoc, temporary wireless LANs set up between a small number of computers would not then be practicable.

3.16 WINforum is an industry group which is developing basic unlicensed PCS standards

Xircom is an active supporter of WINforum, a group of 40 commercial companies with interests in unlicensed PCS products. Considerable progress has been made by WINforum's technical committee towards a set of basic access standards for wireless products, and we believe that this work will be of great value to the Commission in defining operating rules for unlicensed products.

Other industry committees, including IEEE 802.11, also have a role to play in developing detailed protocol standards that will build on Part 15 rules to allow interoperation between products from different manufacturers.

3.17 WINforum can act as a focus to provide new frequencies for present users of the 1910 to 1930 MHz band

WINforum is developing proposals which would allow the 1910 - 1930 MHz band to be made available for unlicensed use without detriment to existing users.

Xircom supports these activities, and we expect that financially and logistically satisfactory arrangements can be made for all parties.

XIRCOM CORPORATION

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ATTACHMENT A
ACCESS PROCEDURES FOR UNLICENSED PCS

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GENERAL REQUIREMENTS

1.1 All transmitters must be associated with matching receivers capable of detecting input power at least across the bandwidth occupied by the transmitter.

1.2 A transmitter/receiver pair must use the same antenna for transmission and reception.

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1910 TO 1920 MHZ ASYNCHRONOUS SUB-BAND

2.1 The overall time constant of the receiver input power detection process, including pre- and post-detection filtering, must not exceed 10 μs.

2.2 Under no circumstances may transmissions be initiated while receiver input power is greater than -60 dBm.

2.3 No transmission may be initiated unless receiver input power has been less than -60 dBm for at least 20 μs. No more than 5 μs may elapse between initiation of a transmission and full RF power output.

2.4 No transmission may exceed 10 ms duration.

2.5 If incoming signal power has been detected, a back-off period of N x 20 μs must be observed, after the received signal ceases, before transmission can be initiated. N is an integer between 1 and 15, which must be selected at random each time the back-off procedure occurs.

2.6 If signal energy is detected during the back-off period, the back-off process must start again, with a new value for N.

2.7 If detected input power can be positively identified as coming from another transmitter in the same system, requirements to wait or back-off before transmission are waived. However, transmissions under this provision must be initiated no later than 5 μs after input power ceases. The maximum duration of such transmission sequences must not exceed 10 ms.

2.8 After each transmission or transmission sequence, the N x 20 μs back-off period must be observed before initiating a new transmission.

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1920 TO 1930 MHZ ISOCHRONOUS SUB-BAND

3.1 The overall time constant of the receiver input power detection process, including pre- and post-detection filtering, must not exceed 100 μs.

3.2 Under no circumstances may transmissions be initiated while receiver input power is greater than -70 dBm.

3.3 No transmission may be initiated unless receiver input power has been less than -70 dBm for at least 20 ms. No more than 5 ms may elapse between initiation of a transmission and full RF power output.

3.4 If incoming signal power has been detected, a back-off period of N x 20 ms must be observed, after the received signal ceases, before transmission can be initiated. N is an integer between 1 and 15, which must be selected at random each time the back-off procedure occurs.

3.5 If detected input power can be positively identified as coming from another transmitter in the same system, requirements to wait or back-off before transmission are waived. However, transmissions under this provision must be initiated no later than 5 ms after input power ceases.

3.6 If no transmitter in a system has traffic, all transmissions will cease.

3.7 It is expected, but not required, that if incoming signal power from a 'foreign' system is detected, a search will be made over the other isochronous channels for an unoccupied channel.

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DISCUSSION

4.1 Basic principles and compromises

This access procedure is based on established principles for carrier sense multiple access communications. It does not require manufacturers to agree on modulation methods and packet formats, and gives substantially better performance than simple ALOHA, which effectively describes the free-for-all that occurs with present Part 15 systems.

4.2 CSMA threshold

A critical part of any CSMA procedure is the threshold used to determine whether or not the channel is occupied. If this threshold is too high, then efficiency is reduced, ultimately to the level of simple ALOHA. If it is too low, then efficiency is also reduced, because transmitters will be inhibited by signals from other users at extended range, when in fact no interference would be caused if transmission were allowed to proceed.

4.3 Comparison between sub-bands

The access procedures suggested for the asynchronous and isochronous sub-bands are similar. However, in the asynchronous case, several systems could be sharing the same frequency space on an intermittent basis, while the isochronous rules allow one system to reserve a channel for as long as that system has traffic to pass.